

Advanced Technology Centre
Innovation delivered

Steven Harris, BSc, PhD

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Professional Profile

I am a Chemist, in the aerospace industry that specialises in materials related projects. My key area of expertise is in the analysis of surfaces and the properties of these surfaces. My current responsibilities are more project management related, and I have a successful track record in both project management and technical contributions to projects.

Principal Skills and Experience**Technical Areas:**

Paints, Sealants, Corrosion, Conversion Coatings, Diffusion Bonding of Aluminium Alloys, Metal Matrix Composites, Analytical Support, Surface Analysis, Corrosion Sensors, Adhesion, Welding & Composites.

Technical Responsibilities:

Development of the surface analysis suite at ATC-Sowerby; Specifying and subsequently purchasing the following major facilities for the ATC: XPS, AES, SIMS, STM, SEM, EDX, AFM, XRD, VPSEM.

Development of the corrosion sensor technology for aerospace applications, this includes a management and technical role in application of this technology to land, air and sea platforms.

Management of the ATC research on welding, adhesive bonding, coatings, NDT, bio sensors (Stress Measurement), environmental monitoring, platform corrosion and the evaluation of stealth coatings.

Employment History**BAE SYSTEMS Advanced Technology Centre (ATC)**

www.baesystems.com

Current Job Title:

Core Title: Group Leader Materials Engineering Research
BAE Systems ECP Manager (Core Engineering Research Programme)
Sales/Marketing Liaison for Materials Department as part of the ATC extended marketing team.

Career Profile:

1988-2007 Materials Sciences Department at the Advanced Technology Centre, Sowerby Building. Listed below is a summary of major internal BAE Systems and collaborative projects I have been involved with since 1989.

Internal Projects:

1989-1990 Corrosion of Metal Matrix Composites (Project Leader)
1990-1996 Diffusion Bonding of Al-Alloys (Project Leader)
1993-1998 Adhesive Bonding Technology (analytical support to the project team)

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1997-2001 Paints and Coatings (Project Manager), project now part of Life Cycle Technologies
 1997-1999 Sealants (Project Manager)
 1997-2000 Advanced metallics (Project Manager)
 1999-2001 Modeling Metallic Corrosion (Project Manager)
 1998-2007 Multi-Functional Corrosion Sensors (Project Manager), project now part of Life Cycle Technologies (ECP 3000 Platform Technologies)

Collaborative Projects:

1990-1992 **DUWLAP**, EU programme, Analytical support to OLT
 1991-1994 **ABHTA**, EU, Analytical support to main programme
 1993-1995 **INDAL**, DTI, Analytical support to OLT
 1996-1998 **NAWM**, EU, Analytical support to OLT
 1997-2000 **NcMAT**, EU, Analytical support to main programme
 1997-2001 **MaSSPS**, EU, Project Manager
 1998-2001 **ACC**, OFFSET with DSTO/CSIRO, ATC-Project Leader
 1998-2002 **CPM**, OFFSET with DSTO/CSIRO, Analytical support to main programme
 2002-2005 **Picasso**, Development of sprayable RAM coatings for Air Vehicles

1983 - 1984 Placement year with UKAEA Winfrith in the Light Water Reactor Group

Education**Southampton University**

1985-1988 PhD in Surface Science fully sponsored by UKAEA Winfrith. Title of PhD
 "Application of Surface Science to the Study of the Corrosion of PWR Primary
 Circuit Materials". Received PhD, August 1989.

University of Portsmouth

1981-1985 BSc in Applied Chemistry (Hons) 1st

Membership of Professional Bodies

Member of the Institute of Corrosion (1992-2003)
 Fellow of the Royal Microscopy Society (1992-2001)
 SRC/EPSCRC Structural Materials Panel (Since 1992)
 ISO TC201: Surface Chemical Analysis (Since 1992)
 BSI CII 60: Surface Chemical Analysis (Since 1992)
 BSI STI/10 Test Methods for paints (Since 2001)
 BSI STI/21 Surface preparation of steel (Since 2001)
 BSI STI/32 Anodic Oxidation Coatings On Aluminium (Since 2001)
 BSI STI/37 Methods of metallic and related coatings, including corrosion tests (Since 2001)
 BSI STI/38 Chemical Conversion Coatings (Since 2001)
 Secretary of UK ESCA Users Group 1993-2000
 Secretary of UK SAF 2000-2006.
 Non-executive committee member of UKSAF 2006
 NPL Advisory Committee for the Valid Analytical Measurement (VAM) programme (1993)

Achievements

2001- 2006 **Chairman's Awards**
 Bronze Integrated Corrosion Sensing System
 Bronze Condition based maintenance for JSF
 Bronze Making Dumb Munitions Smart

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Bronze Weld Guided Waves – seeing the unknown
Bronze In-situ Airframe Analysis (TNA)
Bronze Paint Rejuvenation (Patent)
Bronze Sprayable RAM
Bronze Development of Molecular Modeling (DFT) for Aerospace Applications
Silver Multi-Functional Corrosion Sensors (Patent)
Silver Corrosion Prediction Model

Co Author of 3 patents, on corrosion sensing and paint surface treatments. I have made technical presentations at >20 international conferences and workshops since 1993, on topics ranging from diffusion bonding of aluminum alloys, to the surface chemistry of aerospace sealants.

University Links

Visiting lecturer at Bristol, Birmingham and Surrey University for a number of post graduate courses on surface analysis, corrosion and adhesion science

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**RECEIVED
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In re Patent Application of

WEST et al.

Serial No. 10/535,493

Filed: May 18, 2005

For: ASSEMBLY OF SEALED COMPONENTS

Atty. Ref.: SCS-540-563

TC/A.U.: 1791

Examiner: J. Goff II

* * * * *

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

DECLARATION OF DR. STEVEN HARRIS UNDER RULE 132

I, Steven Harris, hereby declare as follows:

1. That I am a chemist currently employed by BAE Systems – Advanced Technology Center (ATC) at Sowerby, United Kingdom;
2. That my educational and professional experience is listed in the attached CV dated 8 August 2007;
3. That I have been asked to review the above-identified patent application as originally filed, the claims in the October 1, 2007 Amendment and the Official Action mailed on December 12, 2007 by the U.S. Patent and Trademark Office and I have reviewed these three documents;
4. In the Examiner's rejection of independent claim 22 under §102 as being anticipated by John (U.S. Patent 3,022,870), the Examiner contends that "the claimed

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product appears to be the same or similar to that of the prior art, although produced by a different process.”

5. While the Examiner’s initial conclusion is understandable, it is incorrect and does not reflect knowledge of the properties of cured sealant as opposed to uncured sealant or the difference in properties depending upon when curing occurs during the assembly process.

6. Claim 22 requires an assembly of surfaces “having a layer of polysulphide sealant cured thereon prior to assembly.” A “cured” layer of polysulphide sealant is a sealant which has reached a Shore A hardness of approximately 39 and which is tack free, will not adhere to other materials, e.g., glass or metal, upon contact or under light pressure, e.g., finger pressure, and which will have good levels of environmental resistance.

7. With respect to claim 22, the Examiner’s rejection under 35 USC §102(b) is based upon John disclosing the claims “layer of polysulphide sealant cured thereon prior to assembly” which is simply incorrect.

8. The Examiner also states with respect to the rejection of claim 1 under 35 USC §103 that the John reference teaches “applying a cured polysulphide sealant to at least one of the mating surfaces” in section 5 on page 3 of the Final Rejection and this statement is similarly incorrect.

9. Those of ordinary skill in the art will be well aware of the benefits of the invention claimed in claims 1 and 22 in view of Applicants’ specification, i.e., the pre-assembly curing of polysulphide sealant. These benefits of curing the sealant prior to

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bringing together the mating surfaces are a significant improvement over known processes and provide a number of unexpected advantages.

10. The benefits of pre-assembly curing of sealant on one of the mating surfaces include a resultant layer of sealant that is thicker and will exist across the faying or mating surfaces. This benefit is because the sealant layer, having already been cured, is not prone to squeeze out near fasteners (which provide the mating pressure), as the sealant is never in the liquid phase when under compression.

11. The pre-assembly curing of sealant also tends to result in less broken sealant between the components in the joint of the invention. The cured sealant bond has a typical strength of 3.5 to 5 MPa and, because of the curing of the sealant prior to assembly of the mating surfaces, the sealant layer will not be in tension but will normally be in compression.

12. During the known and conventional sealant process as disclosed in John, sealant is applied in the liquid phase to one of the mating surfaces which is then brought into contact with the other mating surface and they are fastened together within the working time of the sealant, i.e., prior to its becoming cured. The joint is then left undisturbed until a significant level of cure is attained.

13. The consequence of post-assembly curing is that the resulting layer of sealant will be thin, owing to the mating surfaces being fasted together with the sealant still in the liquid phase being squeezed out from between the surfaces.

14. The post-assembly cured sealant will also be under slight tension due to the inherent shrinkage occurring during curing process.

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15. The post-assembly cured sealant will be almost completely absent from area immediately surrounding fasteners (holding the two mating surfaces together) because the fasteners hold the areas tightly against one another, thereby excluding sealant therefrom.

16. With the cured sealant assembly process, there is a thicker layer of sealant in the vicinity of fasteners, there is no metal-to-metal contact (which could otherwise take place with the uncured sealant being squeezed out of the space between the two contact surfaces), especially in the vicinity of the fasteners. The uncured sealant is simply not stable enough to resist squeezing of the sealant out of the joint when the joining pressure is applied. In the present invention, because the sealant is fully cured, it does not squeeze or flow under assembly pressure.

17. Turning now to the error in the Examiner's understanding, i.e., that the John reference teaches sealant curing prior to assembly. Those of ordinary skill in the art in the polysulphide sealant field will be well aware that polysulphide sealants typically cure in around 14 days and this is disclosed in the originally filed specification at page 6, lines 18-20.

18. In the John reference at column 2, lines 63-64, there is a statement that the mixture used cures in about 2 hours to a non-spreadable state. John at column 2, line 71 to column 3, line 2, states that the curing is completed within about 12 hours. Based upon these disclosures in John, it would be clear to those of ordinary skill in the art that John's polysulphide sealant is not "cured" either as described in Applicants' specification and claims or as known to those of ordinary skill in the art.

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19. Based upon the disclosure of the alleged curing cycles in John, it is clear that the John polysulphide sealant may never achieve more than 50 to 70% cure during the time periods specified. In the time period for polysulphide sealant curing specified in the current specification, i.e., 14 days, the sealant is approximately 99% cured and therefore this is the definition to the word "cure" as used in the specification and the claims. Thus John discloses an un-cured polysulphide sealant in his assembly process.

20. In column 1, line 1 of the John patent, it is stated that "[t]his invention relates to adherent polymeric films or strips" An "adherent" film or strip sticks to things by electrostatic force. The polysulphide sealant of the present invention is not "adherent." After fully curing, the presently claimed polysulphide sealant does not stick to anything when pressed against it. The cured polysulphide sealant only forms a bond when it is pressed against something for a period of time. Thus John discloses an un-cured polysulphide sealant in his assembly process.

21. Column 1, lines 13-15 of John states "thin self-sustaining films or strips having a polysulphide polymer base which are adherent to clean aluminum surfaces." The present invention's polysulphide sealant does not adhere to clean aluminum surfaces or to any other surface in its fully cured state. Thus John discloses an un-cured polysulphide sealant in his assembly process.

22. Column 1, lines 47-49 of the John reference states "[f]irm plastic films, on the other hand, do not make adequate contact with the faying surfaces and do not provide a fully effective sealer." This passage would lead those of ordinary skill in the art away from the present invention by indicating that films which are apparently similar in

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consistency to the sealant of the present invention do not make "adequate contact" with the mating surfaces after curing. Thus John discloses an un-cured polysulphide sealant in his assembly process.

23. Column 1, lines 59-63 of John states that "[i]t [the film] does not adhere to the fingers, nor indeed to most materials on temporary contact, but is found to adhere to clean aluminum as well as many other surfaces when held briefly in contact therewith." As noted above, the cured sealant of the present invention does not do this or have this feature and thus John discloses an un-cured polysulphide sealant in his assembly process..

24. Column 1, lines 68-70 of John states "[i]t adheres to the metal surfaces, forms a continuous sealing layer therebetween and effectively prevents passage of air and liquids." Again, this teaching in the John reference stipulates adherence of the film to the metal, which does not occur with the cured sealant of the present invention. Thus John discloses an un-cured polysulphide sealant in his assembly process.

25. Column 3, lines 5-9 of the John reference states "[t]he film produced as just described is found to be strongly adherent to glass and only slightly less adherent to clean aluminum. It may be removed from one of the protective polyethylene films and adhered to a metal surface under slight finger pressure." This passage in John again leads me to strongly believe that the film used in the John assembly process is nowhere near a fully cured polysulphide sealant.

26. John at column 3, lines 43-45, states "[i]n place of maleic anhydride, other equivalent adhesion-imparting acidic materials such as dichloromaleic anhydride and itaconic anhydride may be used." Again, this is further evidence to me that polysulphide

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sealant film in John is not cured before completion of his assembly process and that acidic bonds are being formed with the metal substrate during the post-assembly curing process.

27. Finally, John at column 3, lines 64-67, states [a]n excessive cure, on the other hand, reduces the adhesive properties of the film to a degree which makes it difficult to apply in commercial sealing operations, e.g., in the assembling of an aircraft." This passage clearly teaches away from the current invention because John's "excessive cure" is a reference to a fully cured polysulphide sealant, as would normally be understood by those of ordinary skill in the art. Of course, in the present invention wherein the fully cured sealant layer is tack free and in a condition where adhesion to surfaces cannot take place.

28. Thus, based upon the above, I conclude that the John reference does not teach that the layer of polysulphide sealant is cured "prior to" assembling the mating surfaces, whereas this pre-assembly curing is positively recited both in method claim 1 and in assembly claim 22.

29. The Examiner, in the sentence bridging pages 2 and 3 of the Final Rejection, suggests that where a claimed product "appears to be the same or similar to that of the prior art, although produced by a different process, the burden shifts to applicant to come forward with evidence establishing an unobvious difference between the claimed product and the prior product." Numerous differences between the resultant assembly when accomplished in the manner of the John patent and when accomplished in the manner of claims 1 and 22 have been noted, i.e., (a) the assembled components

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utilizing pre-assembly curing in accordance with the presently claimed invention have a thicker sealant layer (whereas in John, the un-cured sealant will be squeezed out from between the faying surfaces); (b) the cured layer extends more uniformly across the mating surfaces; (c) there is also a sealant layer in the area of the fasteners (whereas in the post-assembly cured process of John, the sealant layer will be squeezed out under the fasteners allowing metal-to-metal contact); and (d) as a result of the pre-assembly curing, the sealant layer, after assembly, will normally be in compression (whereas due to shrinkage during curing, the sealant layer in John will be under tension).

30. Because of the above differences between the assembled product having pre-assembly curing of the polysulphide sealant as opposed to post-assembly curing as in John, it is clear that there are significant benefits which were apparently unrecognized by the John patent (and any other prior art references).

31. For the above reasons, the assembled "assembly" of claim 22 is substantially different from any assembly in accordance with the John patent. Furthermore, such differences would be readily obvious to those of ordinary skill in the art in view of the present application.

32. That I declare further that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

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Date: _____

Dr. Steven Harris

Attachment:
CV of Steven Harris, BSc, PhD

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